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The Evolution of Quality Concepts and the Related Quality Management

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Abstract

Enterprises usually adopt some quality practices to control the product quality during the manufacturing process in order to assure the delivery of qualitative good products to customers. The quality practices or quality management systems adopted by industries will further evolve due to the changes of quality concepts as time goes by. This chapter discusses the change of quality concepts and the related revolution of quality management systems in the past century. The quality concepts were gradually changed from the achievement of quality standards, satisfaction of customer needs, and expectations to customer delight. Since merely satisfying customers is not enough to ensure customer loyalty, the enterprises gradually focus on customers' emotional responses and their delight in order to pursue their loyalty. The emotion of "delight" is composed of "joy" and "surprise," which can be achieved as the customers' latent requirements are satisfied. Thus, the concept of "customer delight" and the means to provide the innovative quality so as to meet the unsatisfied customers' latent needs are elaborated on. Finally, a framework of innovation creation is developed that is based on the mining of customer's latent requirements. This outline will manifest the essential elements of the related operation steps.

Keywords: quality concept, customer satisfaction, customer delight, customers' latent requirement, innovation creation system

1. Introduction

It is widely recognized that consumers only buy the goods with good quality, desired functions, and accepted price [1]. Therefore, industries always adopt several management practices, or even develop some management systems to design and produce the products so as to meet customers' needs and expectations showcasing good quality and lower costs. But the

management practices or systems adopted by the industries are always changed due to the changes of the quality concepts as time goes by. This occurs as several quality gurus give the pragmatic definitions of “quality” over different time periods, thus causing industries to implement different practices or systems to control overall product quality [2].

In the first three decades of the last century, quality was defined as “conforming to the standards and specifications of a product” [3]. Thus, the commonly adopted quality practices by industries were the standardization of quality, inspection, and rework. Deming emphasized that “quality is to fulfill the requirements of customers and satisfy them” [4]. Hence, the meaning of quality was gradually changed to a “customer-focused” perspective. Enterprises, therefore, committed themselves to satisfy customers’ needs and expectations. Their aim was to pursue customer’s satisfaction and loyalty [5, 6]. Companies also developed a number of methods to find out customers’ needs and expectations. To this end, in-depth interviews with customers were performed, customer surveys conducted, and market research was done. But, when Apple announced several innovative products, and their sales were increasing, it became apparent that only satisfying customers’ requirements are not enough [7]. As a matter thereof the identification and fulfillment of customers’ unsatisfied latent needs was gauged in conjunction with their emotional responses [8].

Entering the new century, several studies have suggested that merely satisfying customers is not enough to ensure their loyalty [9–11]. The industries need to focus on the customer’s emotional responses and provide the products with attractive quality in order to pursue customers’ delight [11]. It is worth mentioning at this point that Apple is regarded as a future trend setter, as it successfully created several innovative products such as iPod, iPhone, and iPad, triggering increased sales. A strong customer service department equally assisted in causing customers’ delight experiences [12].

In view of the above, quality concepts have changed. Terms such as “customer delight” are deemed as forming the crucial elements of quality concepts, which are coined as “attractive quality” and “innovative quality” [13]. The conceptualization of delight is that the emotion of “delight” is composed of “joy” and “surprise,” which can be achieved as the customers’ latent requirements are satisfied. The provision of innovative quality products is the strategic tool to meet the unsatisfied customers’ latent needs and their curiosity. These changes of quality concepts will lead the enterprises to reengineer their existing quality system, in order to develop the innovative quality attributes of products and services alike so as to retain and attract customers. This scenario causes the quality professionals and researchers to further develop and expand the new quality system beyond TQM. Based on performed research it is the author’s view that research should focus on developing an effective new quality system.

During the past century, several quality gurus had led the changes of quality concepts. This chapter will discuss the changes of quality concepts during different time periods over the past century. To this end, it will also state the reflected revolutions of quality management systems with respect to the changing quality concepts. These are arranged in Sections 2 and 3, respectively. The development of “total quality management” (TQM) philosophy in the 1980s was an important landmark, which caused the change of new quality concepts and the reengineering of the quality management system, as introduced in Section 4. Based on

the performance evaluation of the TQM implementation of TQM, it is worth noting at this point that the “business excellence model” had been proposed during the 1990s. This is elaborated in Section 5. This chapter also introduces the development of an integral model of a business excellence system beyond TQM, based on the realization of TQM.

Section 6 expands on the changes of new quality concepts pertaining to “customer delight” and “innovative quality” based on the investigation of customers’ latent needs in the new century. This chapter includes a system, which may assist and cater for identifying and foster upon customers’ undersatisfied latent needs and delights, enhancing innovative quality, which is addressed in Section 7. The conclusion of this chapter is listed in the final section.

2. The early quality concepts and the reflected quality management system

Since the early twentieth century, manufacturing processes and activities initiated the control practices to assure the product quality [14]. Manufacturing companies focused on the related productivity and manufacturing costs. As such, the quality concept and control were product-focused.

2.1. The quality concept of “standard” and the “inspection” control

In 1913 Ford Motor Company, FMC, created the assembly line in their newly opened factory in Highland Park, Michigan due to the influence of the scientific management of Frederick W. Taylor. This resulted in Ford increasing its manufacturing volume [15]. Ford's assembly line was copied by many manufacturing companies. However, companies turned their attention to control product-related quality issues. Since manufacturers were more “product-focused” in that time, the quality concept was, therefore, aimed at “conforming to the standards and specifications of a product” [3]. This in turn, impelled quality engineers in manufacturing industries to implement the method of “inspection” so as to control the quality of a manufactured product.

Product designers and process engineers designed the standards and specifications of the products, which were based on their critical attributes. They also set up the standards of the manufacturing process and the standards of operations (SOPs). In doing so, the involved workforce was requested to perform the tasks according to the developed SOPs. The quality inspectors checked the dimensions and characteristics of products, detected the errors and failures, and took the necessary actions to improve the product quality.

2.2. The development of process quality control

In order to ensure product quality, companies needed to utilize the “full inspection” method. This was costly, since it required much time and labor efforts, and resulted in high internal quality costs [16]. Walter Shewhart, thus, created the control chart, a quality technique tool that he pioneered in Bell Laboratories working as a quality control engineer [17]. He proposed the use of a sampling inspection method instead of a 100% inspection to reduce the overall

amount of inspection. The control chart was utilized to monitor the quality performance concerning the critical aspects of a process, whereas the attributes of the product were identified by means of sampling methods [18]. This enhanced overall effectiveness and also reduced the associated costs.

Sampling inspection and control charts use many statistic tools such as probability theory, the methods of random sample, analyses of sample mean and deviations to name but a few, as means for improving quality levels. Hence, the method of quality control suggested by Shewhart was called “statistical process control” (SPC) or “statistical quality control” (SQC). Sampling inspection may not always ensure product quality, as it might cause fewer defective products to be shipped to customers [19]. As a result, thereof, it leads to extra outside quality costs. Shewhart, however, had argued that if the missed number of defects was small, then the savings in inspection costs made it worthwhile [20].

3. The quality concepts and the reflected quality management system in the mid-twentieth century

More often than not, quality and the associated price of the goods are primary factors that are considered by customers prior to them materializing a purchase [21]. As such, manufacturing companies mainly emphasis on the control of quality and costs during the manufacturing process, especially the ones that trigger poor quality.

3.1. The development of “quality costs”

In essence, Juran propounded the concept of “quality costs” in his book *“Quality Control Handbook”* in 1951 [22]. Juran subdivided the quality costs into prevention, appraisal, internal failure, and external failure costs. The performed literature review indicates that the losses due to the production of defects and manufacturing failures are more than the costs of quality control; in particular, the costs caused by internal and external failures. In view of the above, the implementation of SPC could not effectively control the quality costs.

Despite this general classification being still widely used by practitioners and researchers, several authors had suggested other kinds of quality costs, especially the “invisible” or “hidden” costs. The term hidden cost is used to indicate failure costs that are inadequately recorded in company accounts and/or failure costs that are never actually discovered. Yang addressed the hidden costs through the definition and addition of two new categories: “extra resultant cost” and “estimated hidden cost” [16]. As such, the quality costs can be subdivided into the following six categories:

- prevention costs
- appraisal costs
- internal failure costs

- external failure costs
- extra resultant costs and
- estimated hidden costs

Figure 1 depicts the new definition of quality costs.

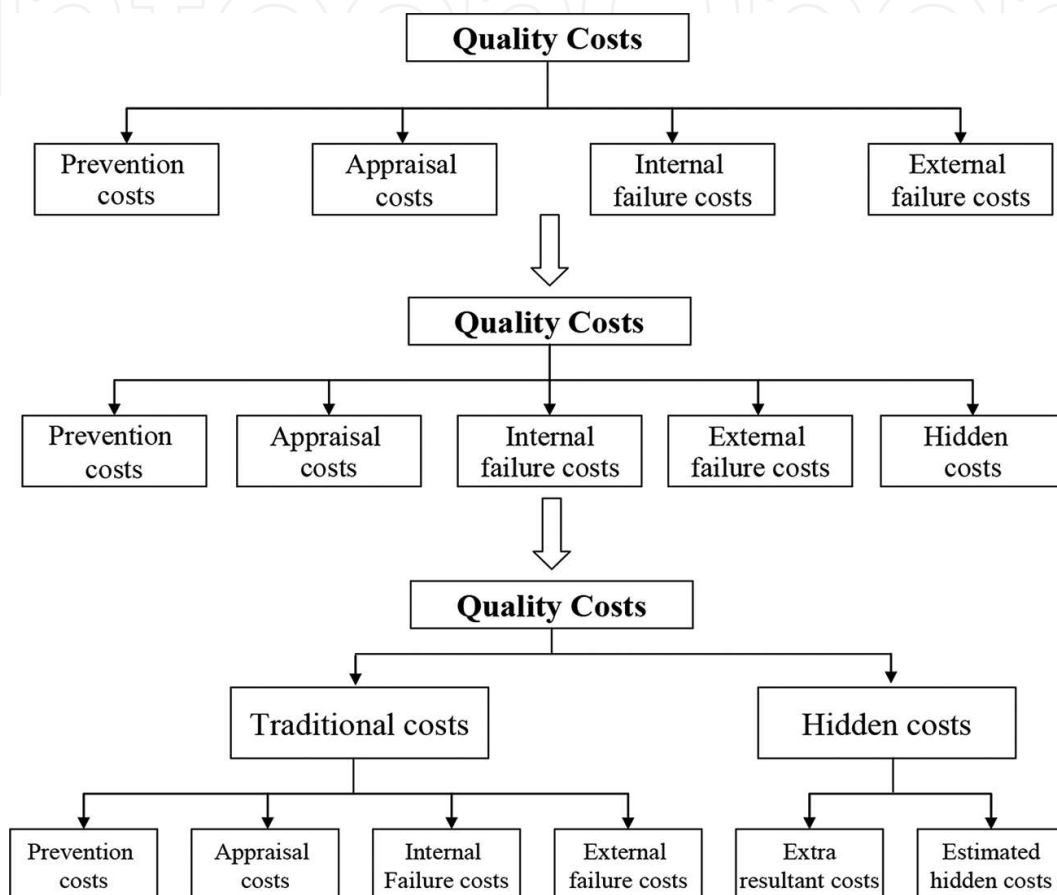


Figure 1. Definition of categories of quality costs.

3.2. The quality concept “quality assurance” and the related TQC-system

After Juran and several quality experts emphasized the quality cost issue, the concept of quality costs was widely accepted by industry. Meanwhile, another quality concept appeared gradually, namely “quality assurance.” However, a large number of experts in the area of quality control, including Feigenbaum, asserted that implementing an SPC system on its own could not effectively control quality costs [23]. It is worth mentioning that the concept of “quality assurance” was “users-oriented,” implying that “product possesses the fitness for purpose of use based on its functions” and hence “quality is zero defects and meeting the specifications 100%” [24].

The performed literature review suggests that Feigenbaum emphasized that quality assurance could not be achieved by placing the control just on production processes. Thus, the concept of total quality control, TQC, was introduced in 1959. TQC emphasizes that product quality needs to be implemented at all stages of the product life cycle. The sequence of quality activities is briefly shown as:

- product design,
- incoming quality approval,
- process quality control,
- product reliability,
- inventory,
- delivery, and
- customer service.

Actually, Feigenbaum's quality concept and ideas were similar to those described by Deming, Juran, and Crosby [25].

The concepts and approaches of SPC, TQC, and “costs of quality” were introduced in Japan during 1960 by Deming and Juran. The Union of Japanese Scientists and Engineers (JUSE), which was formed in 1946, synthesized the concepts, principles, and approaches of statistical process control and total quality control [26]. JUSE promoted the practices of TQC and the quality concepts pursuing the zero defect culture and executing the task right first time.

4. The age of total quality management

While Japanese industries adopted the TQC practices, they emphasized the education and training of quality for all employees and the cultivation of a quality culture. Therefore, the implementation of TQC in Japanese industries was very different from the original TQC.

4.1. The emerging of the Japanese company-wide quality control, CWQC

Actually, the Japanese TQC possessed several critical characteristics listed as follows:

- customer-focused and quality-first as the quality policies,
- full participation and teamwork,
- education and training of quality for all employees,
- realization of “do the right thing first time,”

- concept and materialization of a “zero defect” culture,
- “continuous improvement” as the key quality activity,
- everyone is responsible for achieving high quality levels,
- emphasizing on the prevention activities and quality assurance,
- cultivating a quality culture environment.

Based on aforementioned critical characteristics, the Japanese TQC was acknowledged as company-wide quality control (CWQC).

The implication of CWQC in conjunction with Japanese industrial competitiveness and strategic advantages facilitated their entrance into western markets. Japanese enterprises enjoyed an increase in global market share by providing the customers with high-quality products at lower prices [27]. This in turn, resulted in western companies facing an increased amount of competition from Japanese and other Asian manufacturers.

4.2. The development of total quality management

The Japanese competition caused American and western industries to implement benchmarking projections by studying Japanese CWQC performances. In doing so, they adopted the principles of Japanese quality management. Based on the critical characteristics listed above, western professionals further developed and refined CWQC to become a total quality management (TQM) system. Its fundamental principles are listed as follows:

- “customer-focused” management,
- “continuous improvement” as the key quality activity,
- top management's promise persistence for pursuing quality,
- full participation and teamwork,
- education and training of quality for employees,
- employees' good quality concept,
- quality leadership,
- long-term supplier relationship,
- implementation of quality management system,
- cultivation of quality culture.

It is the author's view that the TQM was well developed and suitable for western organizations, as depicted in **Figure 2**. Thus, it was widely adopted by industries and nonprofit organizations around the world.

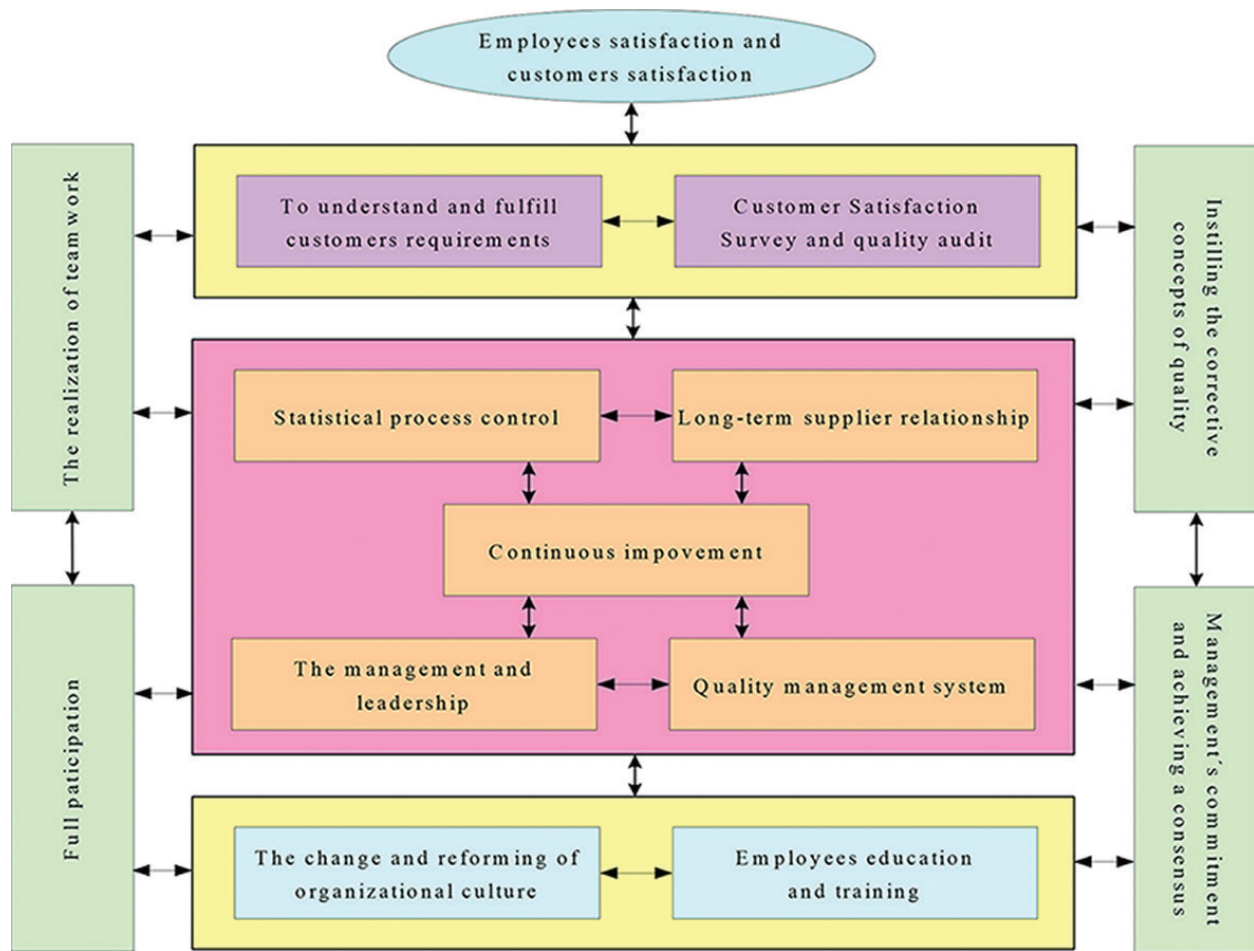


Figure 2. The framework of TQM.

The development of TQM was also influenced by the western quality experts, namely Deming, Juran, and Crosby [28]. As already stated Deming's quality concept was that "quality is to fulfill the requirements of customers and satisfy them" [4]. Crosby's definition of quality was also similar, as he defined quality as "conformance to customers' requirements." Juran also defined quality as being "fitness for purpose of use, ..., it is judged by the users, not the manufacturers, or the merchants" [22]. TQM was thus an integrated model of management philosophies, quality concepts, and a set of practices, which were also influenced by Deming's 14 points and Juran's quality trilogy. However, to implement the TQM successfully it is necessary to integrate the so-called "hard side" elements (that is, statistical methods, quality control tools, process standardization, and improvement, etc.) with the "soft side" aspects (that is, quality concept, employees' participation, education and training, and quality culture, etc.) [29].

From the mid-1980s onward, several important quality programs were being launched. Besides the development of TQM, the ISO 9000 system and the Six-Sigma program (which was initiated by Motorola) commenced in 1987. It is worth noting that up to date, the ISO system has had four revisions in 1994, 2000, 2008, and 2015, respectively.

The Six-Sigma quality scheme was being widely imitated by GE in 1995 [30]. The successful implementation of Six-Sigma by Motorola, GE, and several other multinational companies caused the Six-Sigma philosophy to be globally adopted by a number of industries and organizations [31].

5. From Malcolm Baldrige National Quality Award to the Business Excellence Model

From the late 1990s to present, the traditional quality concept has seen a number of changes. In the United States of America, the Department of Commerce introduced in 1987 the Malcolm Baldrige National Quality Award (MBNQA) by benchmarking the Japanese Deming Award [32] to promote the implementation of TQM in industries and nonprofit organizations.

5.1. The national quality award and TQM

The main aim of TQM implementation is to achieve customers' satisfaction [33]. This in turn results in a company improving its financial performances [34–36]. The benefits may be seen in areas such as cost reduction, increased market share and profit, and enhanced business competitiveness [37]. As a result, MBNQA specifically emphasizes business excellence. Besides the implementation of TQM, MBNQA also considers the strategic management, and information management and analyses.

The European Foundation for Quality Management (EFQM) also launched in 1992 a European Quality Award (EQA) [38]. Based on the performed research, more than 80 countries have established National Quality Awards (NQAs). These NQAs are largely based on the MBNQA, EQA, and the Deming Prize [39, 40], and are generally considered to be an effective way of pursuing business excellence, including customer loyalty and better long-term financial performances. Most of these national quality awards may form part of the TQM system namely, strategic management, performance evaluation, human resource management, and even IT system and innovation.

5.2. Prospects of the business excellence model beyond TQM

The framework of the National Quality Award is indeed beyond the extent of TQM. In most of the cases, National Quality Award such as MBNQA and EQA are acknowledged as a business excellence model, with the industries adopting it as their strategic business system. Yang [41] proposed a framework of an integral model of a business-excellence system based on the integration of TQM, MBNQA, and EQA, and its islands:

- strategic management system,
- performance evaluation, and
- innovation (**Figure 3**).

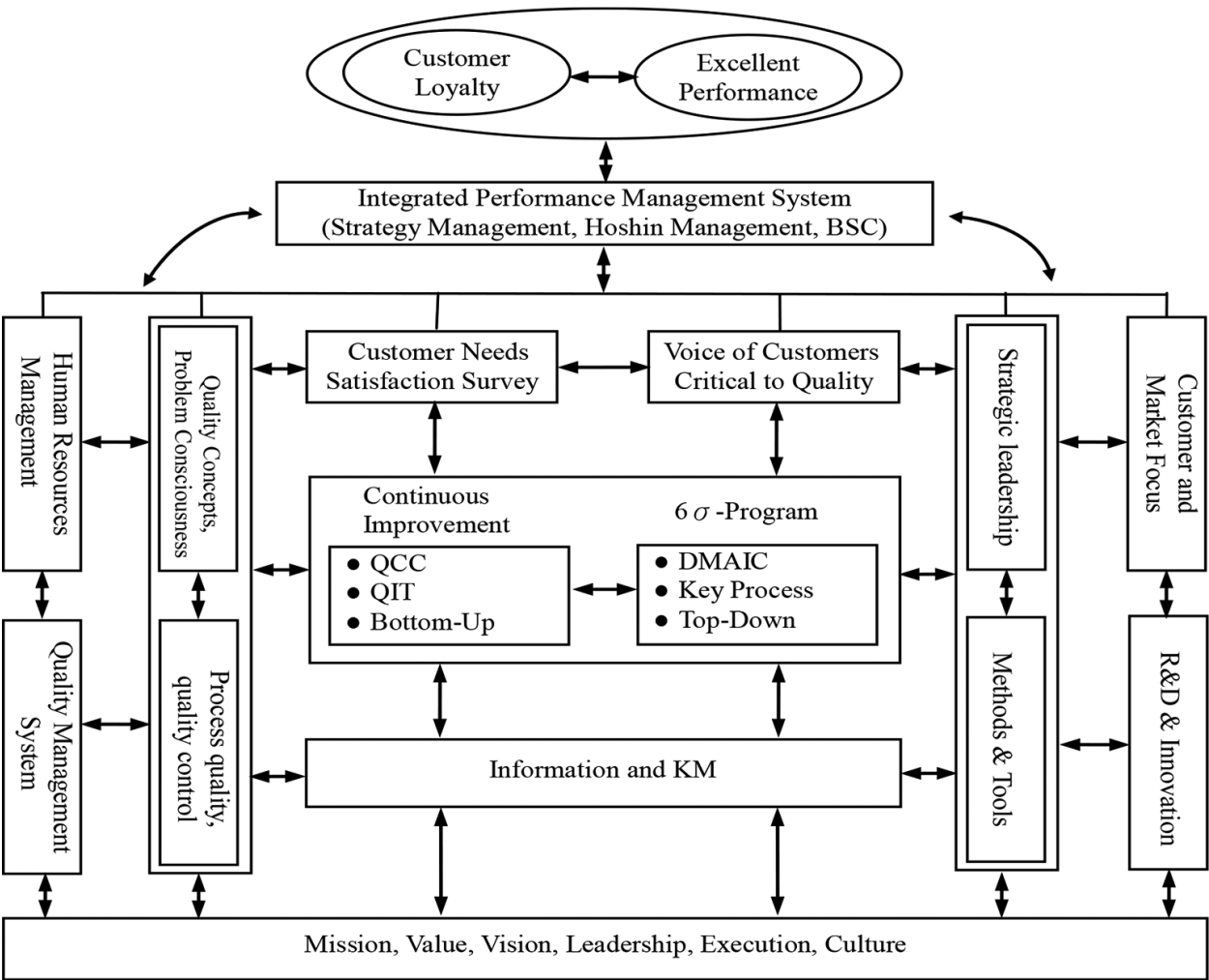


Figure 3. The framework of the proposed integral model of a business-excellence system.

Meanwhile, the concept of “sustainable development” was also widely adopted in industry [42, 43]. Zairi asserted that “sustainable development is based on a perceived need to address environmental deterioration and to maintain the vital functions of natural systems for the well-being of present and future generations” [44]. He thus, proposed an integrated model that incorporates the sustainable development into a TQM system. Yang et al. developed a framework of the system of environmental management, which constitutes of 30 activity items themselves belonging to 12 initiatives [45].

6. The concepts of “customer delight” and “innovative quality” in the new century

A critical strategy of pursuing business excellence is to raise customers’ loyalty, which cannot be assured by grossly satisfying customers. Indeed, even satisfied customers would defect at

a significant rate in many industries. It is recognized that customers' satisfaction is the result of the fulfillment of their explicit needs. As such, satisfaction only of their needs does not directly result in customer loyalty, since the competitors would also fulfill these explicit needs with better customer-valued products [46].

Several studies have revealed that the degree of loyalty depends on whether the customers are "totally satisfied" or merely "satisfied" [47, 48]. The totally satisfied customers are actually about five times more likely to repurchase a product or service than those who are merely "satisfied" [49, 50]. This suggests that enterprises must strive for "total customer satisfaction," or even "customer's delight" [51].

"Customer delight" is a new quality concept. A conceptualization of "delight" is the customer's emotional response, which is composed of "joy" and "surprise" — both encountered in the providing process of goods/services [52]. In order to delight customers, the enterprises need to provide the goods/services with attractive and innovative quality incentives. The strategic actions are to identify customers' latent needs and to create customer value by developing the innovative products and attractive services in order to fulfill these.

If a company brings out some innovative products that consumers did not know they needed before, then these innovative products will often spark high demand [53]. Indeed, Moore illustrated eight types of innovations, namely [54]:

- application innovation,
- product innovation,
- process innovation,
- experience innovation,
- marketing innovation,
- business model innovation,
- structural innovation, and
- disruptive innovation.

These kinds of innovations, especially the first four types, will result in significant effects on the fulfillment of the customers' latent needs and their delight experiences.

7. The development of the innovation system

In order to raise the customers' loyalty, the enterprises should develop the core capabilities with an innovation system. In view of the above, the prerequisite for developing such a system is been described. As such, this chapter proposes a systematic innovation development system based on the product/service value chain.

7.1. The framework of the innovation system

At first, the differences among improvement, reengineering, and innovation are established as shown in **Figure 4**. Improvement is implemented on the existing processes, as some problems may have been encountered during the manufacturing process or the service delivery process. Continuous improvement is the key activity of the TQM system, its aim is to improve the quality of products/services and all the observed and or experienced bottlenecks on the processes. The final objective is to raise customer satisfaction [55].

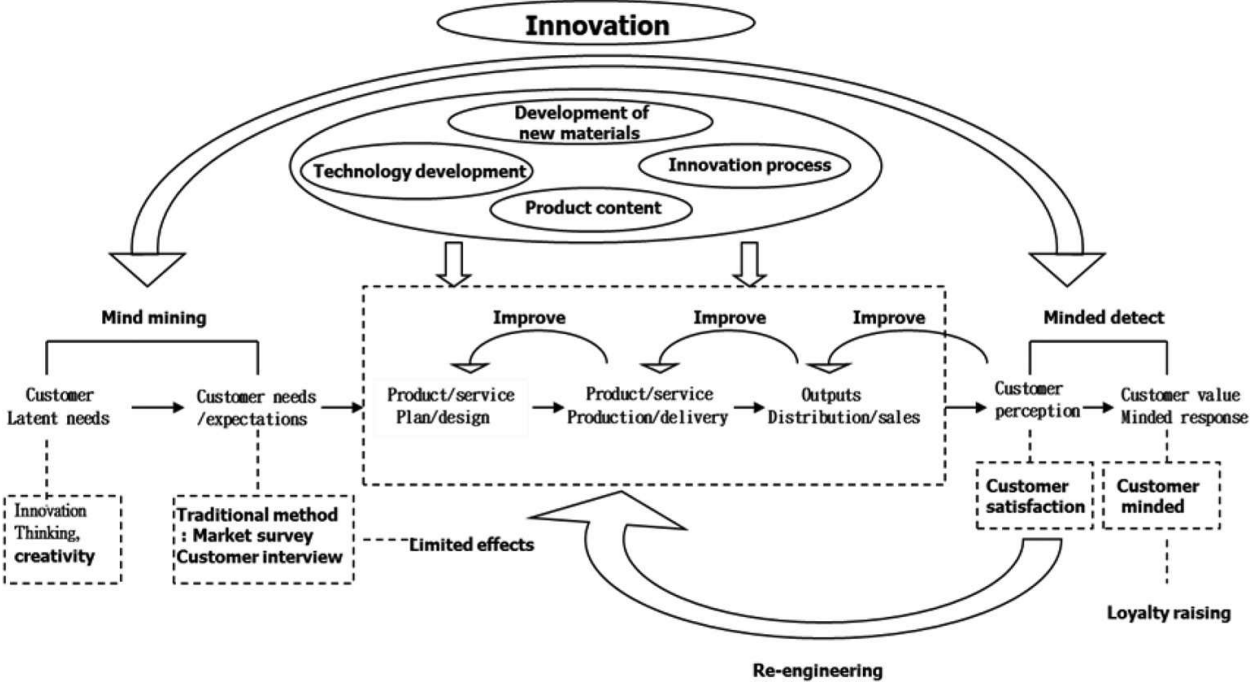


Figure 4. The framework of the innovation system.

Hammer and Champy asserted that improving solely the production system or service delivery processes may not result in significant business performance [56]. Sometimes it is needed to reengineer the critical processes, or to redevelop the provision systems based on customer voices. The latter applies in particular to key customer values which are difficult to fulfill by adopting the improvement actions, as shown in **Figure 4**. Thus, the aim of reengineering is to create customers’ values, which are the critical factors of raising customer loyalty. Besides, reengineering also reaps the benefits including shorter delivery times of products/services (including lead time and production time), reduction of costs, and the effective utilization of resources.

Most companies develop and implement enterprise resources planning (ERP), customer relationship management (CRM), and supply chain management (SCM) simultaneously [57]. By integrating these systems, enterprises can exert excellent business’ performance and customer's loyalty. In order to effectively utilize these networks and their integrated systems, it is the author's view that companies should proceed with the necessary processes of reengineering. This in turn, may have an impact on the critical functional activities on a timely basis.

The utilization of high-tech functions and the rapid application of the internet resulted in the change of customers' purchasing behavior [58, 59]. Customers now focus not only on the evaluations of price and functions; rather they also integrate quality with the perceived value [60]. It is the author's view that business systems ought to change and pursue innovation, speed, and quality if they want to satisfy the overall needs of customers and create new value.

Customer satisfaction may be termed as fulfilling their requirements and expectations. This, however, is not enough for delighting them and raising their loyalty. Performed research indicates that a number of customer's latent needs are never discovered and satisfied by enterprises [61]. Thus, the latter's competitive force is to probe the unmet customers' latent needs. There are some new methodologies proposed by several researchers to pinpoint customers' latent needs [62]. Once the latter are identified, companies ought to overcome bottlenecks and aim at developing and providing innovative products/services to satisfy customers' latent needs and curiosity.

Eventually the customer will be set at the center of innovation. Thomke and von Hippel asserted that "tapping into customer innovation can certainly generate tremendous value, but capturing customer value is hardly a simple or straightforward work" [63]. The term "innovation" is usually considered as a process or a capability to create new ideas, and then develop the innovative products/services in order to meet customers' unsatisfied latent needs [64, 65]. In essence, the realization of "innovation" depends on the implementation of an innovation system, as shown in **Figure 4**. This innovation system starts at the "mind" mining of the customer's latent needs and ends in the customer's value and response, and vice versa.

7.2. The transfer loop of innovation system

In order to effectively implement the innovation system, a transfer loop of the innovation system has been developed, as shown in **Figure 5**. It constitutes of four constructs:

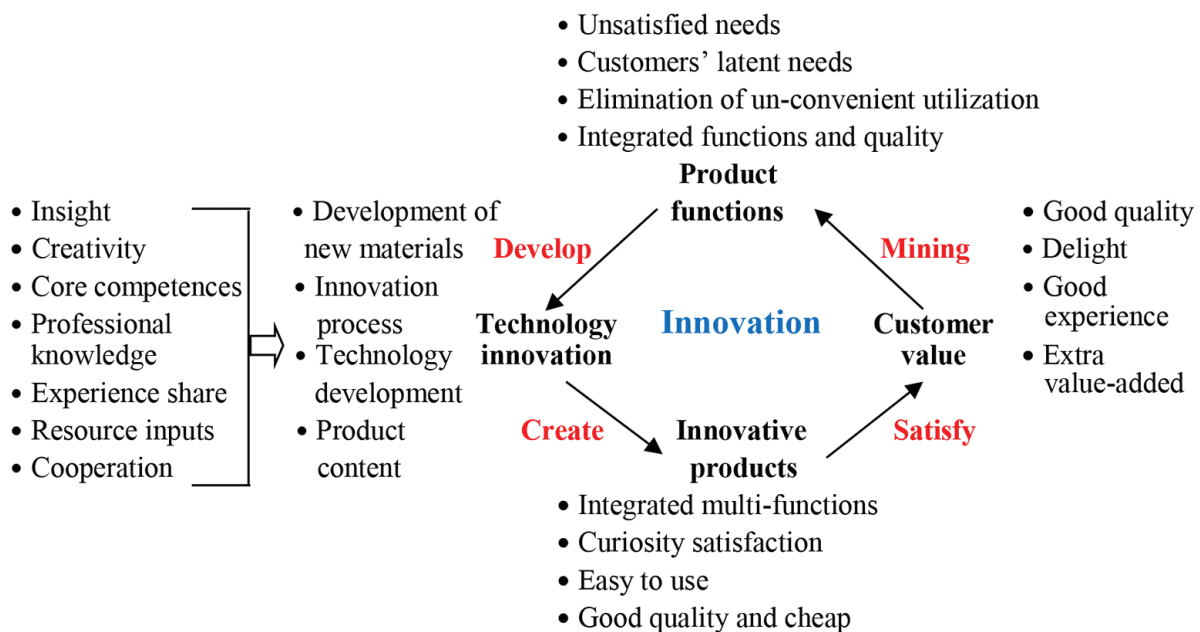


Figure 5. The transfer loop of the innovation system.

- technology innovation,
- innovative products,
- customer value, and
- product functions.

It is worth mentioning that each construct contains several items. As such, the construct “technology innovation” is termed as the fundamental force of innovation, which contains the following items:

- technology development,
- development of new material,
- product content, and
- innovation process.

These are driven by the following core activities:

- insight,
- creativity,
- core capability,
- professional knowledge,
- experience share,
- resource inputs, and
- cooperation.

The effective implementation of “technology innovation” can create the “innovative products,” which includes the following:

- integrated multifunctions,
- curiosity satisfaction,
- easy to use, and
- good quality at an affordable price.

Each of the other three constructs also contains several items. These constructs and their involving items are shown in **Figure 5**.

The features of “innovative products” will satisfy the “customer value” which is accentuated by good quality, delight, good experience, and extra value-added features. In order for the companies to fulfill these characteristics, it is hereby suggested to use “mind mining” methods

to identify customers' unsatisfied and latent needs. They also ought to use methods and means to eliminate the inconvenient utilization, and to integrate product functions and quality. These findings and results may be hereby included into the quality functions. For realizing these quality functions, the drivers are the capability of "technology innovation." As such, the four constructs form a "transfer loop of the innovation system," as shown in **Figure 5**.

8. Conclusion

In a highly globalized economy, it is widely recognized that "innovation" has become the key force for achieving business excellence, which in turn reflects as competitive advantages, growth, and development [66]. Only the pursuit of product quality and service quality is not enough to achieve the business objectives. The enterprises should alter their quality concepts from the narrow definition of quality to include customer value and innovation. In order to realize the innovation performance, this study has proposed a framework of the innovation system and the related transfer loop of the system. However, the proposed system is a conceptual model, empirical studies ought to be conducted to identify potential causalities among the critical constructs and their practices.

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